

## EQUIPMENT SUBMITTAL FOR APPROVAL

**PROJECT:** Syracuse VAMC Chiller Replacement Project

**LOCATION:** Syracuse, New York



**YORK YK *MILLENNIUM*™ CENTRIFUGAL CHILLER**

<b>EQUIPMENT</b>	YK Max E Chiller
<b>UNIT TAGS</b>	CH-1 & 2
<b>QUANTITY</b>	2
<b>Proposal Reference</b>	VA-528-10-RQ-0014

### **SOLD TO:**

Department of Veteran Affairs Medical Center  
800 Irving Avenue  
Syracuse, New York 13210-2799

### **CONSULTING ENGINEER:**

C&S Engineers  
1099 Col. Eileen Collins Blvd.  
North Syracuse, New York 13212

### **PREPARED BY:**

Pro Air Plus, Inc.  
822 State Fair Blvd.  
Syracuse, New York 13209

### **DATE:**

Tuesday, December 22, 2009

### **REVISION:**

0

**GENERAL**

Furnish YORK MaxE Centrifugal Liquid Chilling-Unit(s) as indicated on the drawings.

Each unit shall produce a capacity of 750 tons, cooling 1634 gpm of WATER from 55.00 to 44.00 °F when supplied with 2250 gpm of condenser water at 85.00 °F. Power input shall not exceed 406 KW with an NPLV of 0.361. The cooler shall be selected for 0.00010 fouling factor and a maximum liquid pressure drop of 14.6 ft. Water side shall be designed for 150 psig working pressure. The condenser shall be selected for 0.00025 fouling factor and maximum liquid pressure drop of 11.5 ft. Water side shall be designed for 150 psig working pressure. Power shall be supplied to the compressor motor at 460 volts – 3 phase - 60 Hertz and controls at 115 volts – 1-phase - 60 Hertz. The chiller shall use R-134A.

Each unit will be completely factory-packaged including evaporator, unit mounted starter, condenser, sub-cooler, compressor, open motor, lubrication system, Optiview control center. and all interconnecting unit piping and wiring. The chiller will be painted prior to shipment.

Performance will be certified in accordance with ARI Standard 550/590. Only chillers that are listed in the ARI Certification Program for Centrifugal and Rotary Screw Water Chillers are acceptable.

The initial charge of refrigerant and oil will be supplied, shipped in containers and cylinders for field installation or factory charged in the chiller.

**COMPRESSOR**

The compressor will be a single-stage centrifugal type powered by an open-drive electric motor. The housing will be fully accessible with vertical circular joints, with the complete operating assembly removable from the compressor and scroll housing. Compressor castings will be designed for 235 psig working pressure and hydrostatically pressure tested at 355 psig for R-134A units. The rotor assembly will consist of a heat-treated alloy steel drive shaft and impeller shaft with a cast aluminum, fully shrouded impeller. The impeller will be designed for balanced thrust, dynamically balanced and over-speed tested for smooth, vibration-free operation. Insert-type journal and thrust bearings will be fabricated of aluminum alloy, precision bored and axially grooved.

Internal single helical gears with crowned teeth will be designed so that more than one tooth is in contact at all times to provide even load distribution and quiet operation. Each gear will be individually mounted in its own journal and thrust bearings to isolate it from impeller and motor forces. Shaft seal shall be provided in double bellows, double-seal, cartridge type. A gravity-fed oil reservoir will be built into the top of the compressor to provide lubrication during coastdown in the event of a power failure.

Capacity control will be achieved by use of prerotation vanes to provide fully modulating control from maximum to minimum load. The unit will be capable of operating with lower temperature cooling tower water during part-load operation in accordance with ARI Standard 550/590. Prerotation vane position will be automatically controlled by an external electric actuator to maintain constant leaving chilled water temperature.

**LUBRICATION SYSTEM**

Lubrication oil shall be force-fed to all compressor bearings, gears, and rotating surfaces by an external variable speed oil pump. The oil pump shall vary oil flow to the compressor based on operating and stand-by conditions, ensuring adequate lubrication at all times. The oil pump shall operate prior to start-up, during compressor operation and during coastdown. Compressor shall have an auxiliary reservoir to provide lubrication during coastdown in the event of a power failure.

An oil reservoir, separate from the compressor, shall contain the submersible 2 HP oil pump and a 3000 watt oil heater, thermostatically controlled to remove refrigerant from the oil. The oil reservoir shall be designed and stamped in accordance with ASME or applicable pressure vessel code. A non-code reservoir is not acceptable.

Oil shall be filtered by an externally mounted ½ micron replaceable cartridge oil filter equipped with service valves. Oil cooling shall be done via a refrigerant cooled oil cooler, with all piping factory installed. Oil side of the oil cooler shall be provided with service valves. An automatic oil return system to recover any oil that may have migrated to the evaporator shall be provided. Oil piping shall be completely factory installed and tested.

#### **MOTOR DRIVELINE**

The compressor motor will be an open drip-proof, squirrel cage, induction type operating at 3570 RPM.

The open motor shall be provided with a D-flange, bolted to a cast iron adapter mounted on the compressor to allow the motor to be rigidly coupled to the compressor to provide factory alignment of motor and compressor shafts.

Motor drive shaft will be directly connected to the compressor shaft with a flexible disc coupling. Coupling will have all metal construction with no wearing parts to assure long life, and no lubrication requirements to provide low maintenance.

For units utilizing remote electro-mechanical starters, a large steel terminal box with gasketed front access cover will be provided for field connected conduit. Overload/overcurrent transformers will be furnished with all units. (For units furnished with factory packaged Solid State Starters, refer to the options section.)

#### **EVAPORATOR**

Evaporator will be of the shell-and-tube, flooded type designed for 180 psig working pressure on the refrigerant side. Shell will be fabricated from rolled carbon steel plate with fusion welded seams; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. The refrigerant side will be designed, tested and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII- Division 1. Tubes shall be high-efficiency, internally and externally enhanced type having plain copper lands at all intermediate tube supports to provide maximum tube wall thickness at the support area. Each tube will be roller expanded into the tube sheets providing a leak-proof seal, and be individually replaceable. Water velocity through the tubes will not exceed 12 fps. Two liquid level sight glasses will be located on the side of the shell to aid in determining proper refrigerant charge. Aluminum mesh eliminators will be located above the tube bundle to prevent liquid refrigerant carryover to the compressor. The evaporator will have a refrigerant relief device sized to meet the requirements of ASHRAE 15 Safety Code for Mechanical Refrigeration.

Water boxes and cover plates will be removable to permit tube cleaning and replacement. Stubout water connections having victaulic grooves will be provided. Vent and drain connections with plugs will be provided on each water box.

#### **CONDENSER**

Condenser will be of the shell-and-tube type, designed for 235 psig working pressure on the refrigerant side. Shell will be fabricated from rolled carbon steel plate with fusion welded seams; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. The refrigerant side will be designed, tested and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII- Division 1. Tubes shall be high-efficiency, internally and externally enhanced type having plain copper lands at all intermediate tube supports to provide maximum tube wall thickness at the support area. Each tube will be roller expanded into the tube sheets providing a leak-proof seal, and be individually replaceable. Water velocity through the tubes will not exceed 12 fps.

Water boxes and cover plates will be removable to permit tube cleaning and replacement. Stubout water connections having flanged connection will be provided. Vent and drain connections with plugs will be provided on each water box.

#### **REFRIGERANT FLOW CONTROL**

Refrigerant flow to the evaporator will be controlled by a variable orifice for improving unloading capabilities.

#### **GRAPHIC CONTROL CENTER**

**General:** The chiller shall be controlled by a stand-alone microprocessor based control center. The chiller control panel shall provide control of chiller operation and monitoring of chiller sensors, actuators, relays and switches.

**Control panel:** The control panel shall include a 10.4 in. diagonal color liquid crystal display (LCD) surrounded by "soft" keys which are redefined based on the screen displayed at that time. This shall be mounted in the middle of a keypad interface and installed in a locked enclosure. The screen shall detail all operations and parameters, using a

graphical representation of the chiller and its major components. Panel verbiage shall be available in other languages as an option with English always available. Data shall be displayed in either English or Metric units. Smart Freeze Point Protection shall run the chiller at 36.00°F leaving chilled water temperature, and not have nuisance trips on low water temperature. The sophisticated program and sensor shall monitor the chiller water temperature to prevent freeze up. When needed Hot Gas Bypass is available as an option. The panel shall display countdown timer messages so the operator knows when functions are starting and stopping. Every programmable point shall have a pop-up screen with the allowable ranges, so that the chiller can not be programmed to operate outside of its design limits.

The chiller control panel shall also provide:

1. System operating information including:
  - a. return and leaving chilled water temperature
  - b. return and leaving condenser water temperature
  - c. evaporator and condenser saturation temperature
  - d. differential oil pressure
  - e. percent motor current
  - f. evaporator and condenser saturation temperature
  - g. compressor discharge temperature
  - h. oil reservoir temperature
  - i. compressor thrust bearing positioning and oil temperature
  - j. operating hours
  - k. number of compressor starts
2. Digital programming of setpoints through the universal keypad including:
  - a. leaving chilled water temperature
  - b. percent current limit
  - c. pull-down demand limiting
  - d. six-week schedule for starting and stopping the chiller, pumps and tower
  - e. remote reset temperature range
3. Status messages indicating:
  - a. system ready to start
  - b. system running
  - c. system coastdown
  - d. system safety shutdown-manual restart
  - e. system cycling shutdown-auto restart
  - f. system prelube
  - g. start inhibit
4. The text displayed within the system status and system details field shall be displayed as a color coded message to indicate severity: red for safety fault, orange for cycling faults, yellow for warnings, and green for normal messages.
5. Safety shutdowns enunciated through the display and the status bar, and consist of system status, system details, day, time, cause of shutdown, and type of restart required. Safety shutdowns with a fixed speed drive shall include:
  - a. evaporator – low pressure
  - b. evaporator – transducer or leaving liquid probe
  - c. evaporator – transducer or temperature sensor
  - d. condenser – high pressure contacts open

- e. condenser – high pressure
- f. condenser – pressure transducer out of range
- g. auxiliary safety – contacts closed
- h. discharge – high temperature
- i. discharge – low temperature
- j. oil – high temperature
- k. oil – low differential pressure
- l. oil – high differential pressure
- m. oil – sump pressure transducer out of range
- n. oil – differential pressure calibration
- o. oil – variable speed pump – pressure setpoint not achieved
- p. control panel – power failure
- q. motor or starter – current imbalance
- r. thrust bearing – proximity probe clearance
- s. thrust bearing - proximity probe out – of – range
- t. thrust bearing – high oil temperature
- u. thrust bearing – oil temperature sensor
- v. watchdog – software reboot

5.1 Safety shutdowns with a VSD Shall include:

- a. VSD shutdown – requesting fault data
- b. VSD – stop contacts open
- c. VSD – 105% motor current overload
- d. VSD – high phase A, B,C inverter heatsink temp.
- e. VSD – high converter heatsink temperature

6. Cycling shutdowns enunciated through the display and the status bar, and consists of system status, system details, day, time, cause of shutdown, and type of restart required. Cycling shutdowns with a fixed speed drive shall include:

- a. multiunit cycling – contacts open
- b. system cycling - contacts open
- c. oil - low temperature differential
- d. oil – low temperature
- e. control panel - power failure
- f. leaving chilled liquid - low temperature
- g. leaving chilled liquid - flow switch open
- h. motor controller – contacts open
- i. motor controller – loss of current
- j. power fault
- k. control panel - schedule
- l. starter – low supply line voltage
- m. starter – low supply line voltage
- n. proximity probe – low supply voltage
- o. oil - variable speed pump - drive contacts open

6.1 Cycling shutdowns with a VSD shall include:

- a. VSD shutdown – requesting fault data
- b. VSD – stop contacts open
- c. VSD initialization failed
- d. VSD - high phase A,B,C instantaneous current
- e. VSD – phase A,B,C gate driver

- f. VSD – single phase input power
  - g. VSD – high DC bus voltage
  - h. VSD – pre charge DC bus voltage imbalance
  - i. VSD – high internal ambient temperature
  - j. VSD – invalid current scale selection
  - k. VSD – low phase A, B, C inverter heatsink temp.
  - l. VSD – low converter heatsink temperature
  - m. VSD – pre-charge - low DC bus voltage
  - n. VSD – logic board processor
  - o. VSD – run signal
  - p. VSD – serial communications
7. Security access to prevent unauthorized change of setpoints, to allow local or remote control of the chiller, and to allow manual operation of the prerotation vanes and oil pump. Access shall be through ID and password recognition, which is defined by three different levels of user competence: view, operator, and service.
8. Trending data with the ability to customize points of once every second to once every hour. The panel shall trend up to 6 different parameters from a list of over 140, without the need of an external monitoring system.
9. The operating program stored in non-volatile memory (EPROM) to eliminate reprogramming the chiller due to AC power failure or battery discharge. Programmed setpoints shall be retained in lithium battery-backed RTC memory for a minimum of 11 years with power removed from the system.
10. A fused connection through a transformer in the compressor motor starter to provide individual over-current protected power for all controls.
11. A numbered terminal strip for all required field interlock wiring.
12. An RS-232 port to output all system operating data, shutdown / cycling message, and a record of the last 10 cycling or safety shutdowns to a field-supplied printer. Data logs to a printer at a set programmable interval. This data can be preprogrammed to print from 1 minute to 1 day.
13. The capability to interface with a building automation system to provide:
- a. remote chiller start and stop
  - b. remote leaving chiller liquid temperature adjust
  - c. remote current limit setpoint adjust
  - d. remote ready to start contacts
  - e. safety shutdown contacts
  - f. cycling shutdown contacts
  - g. run contacts

**STARTUP AND OPERATOR TRAINING**

The services of a factory trained, field service representative will be provided to supervise the final leak testing, charging and the initial startup and conduct concurrent operator instruction.

**FACTORY INSULATION**

Factory-applied, anti-sweat insulation will be attached to the cooler shell, flow chamber, tube sheets, suction connection, and (as necessary) to the auxiliary tubing. The insulation will be a flexible, closed-cell plastic type, 1 1/2

inches thick, applied with vapor-proof cement. The insulation will normally prevent sweating in environments with relative humidities up to 90% and dry bulb temperatures ranging from 50 to 90 °F.

#### **ISOLATION MOUNTING**

Included with the unit are four vibration isolation mounts, consisting of 1" thick neoprene isolation pads, for field mounting. The pads are to be mounted under the steel mounting pads on the tube sheets. Suitable for ground floor installation.

#### **SHIPMENT FORM #2**

The unit shall be completely assembled, with all main, auxiliary and control piping installed, controls wired, leak and air run test completed, and charged with dry nitrogen (2 to 3 psig). The oil charge and miscellaneous materials shall be packed separately. The refrigerant charge shall be shipped concurrently or separately in cylinders for field evacuation and charging of unit.

#### **COMPRESSOR MOTOR STARTER**

A variable speed drive will be factory installed on the chiller. It will vary the compressor motor speed by controlling the frequency and voltage of the electrical power to the motor. The adaptive capacity control logic shall automatically adjust motor speed and compressor pre-rotation vane position independently for maximum part-load efficiency by analyzing information fed to it by sensors located throughout the chiller.

Drive will be PWM type utilizing IGBT's with a power factor of 0.95 or better at all loads and speeds.

The variable speed drive will be unit mounted in a NEMA 1 enclosure with all power and control wiring between the drive and chiller factory installed, including power to the chiller oil pump. Field power wiring shall be a single point connection and electrical lugs for incoming power wiring will be provided. The entire chiller package will be UL listed.

The following features will be provided:

- Door interlocked circuit breaker capable of being padlocked.

- UL listed ground fault protection.

- Over voltage and under voltage protection.

- 3-phase sensing motor over current protection.

- Single phase protection.

- Insensitive to phase rotation.

- Over temperature protection.

- Digital readout at the chiller unit control panel of output frequency, output voltage, 3-phase output current, input Kilowatts and Kilowatt-hours, self-diagnostic service parameters. Separate meters for this information will not be acceptable.

**KW Meter** - The unit's input power consumption will be measured and displayed digitally via the unit's control panel. The KW meter accuracy is typically +/- 3% of reading. KW meter scale is 0 - 788 KW

**KWh Meter** - The unit's cumulative input power consumption is measured and displayed digitally via the unit's control panel. The KWh meter is resetable and it's accuracy is typically +/- 3% of reading. KWh meter scale is 0 - 999,999 kWh.

**Ammeter** - Simultaneous three-phase true RMS digital readout via the unit control panel. Three current transformers provide isolated sensing. The ammeter accuracy is typically +/- 3% of reading. Ammeter scale is 0 - 545 A RMS .



Voltmeter – Simultaneous three-phase true RMS digital readout via the unit control panel. The voltmeter accuracy is typically +/- 3% of reading. Voltmeter scale is 0 – 670 VAC.

Elapsed Time Meter – Digital readout of the unit's elapsed running time (0 – 876,600 hours, resetable) is displayed via the unit control panel.



# YK MAXE CHILLER PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model No.	Capacity (tons)	Power	Refrigerant
<b>CH-1</b>	<b>2</b>	<b>YKKQK4H9-CUGS</b>	<b>750</b>	<b>460/3/60</b>	<b>R-134A</b>

Unit Data	Evaporator	Condenser
EWT (°F):	55.00	85.00
LWT (°F):	44.00	94.19
Flow Rate (gpm):	1634	2250
Pressure Drop (ft):	14.6	11.5
Fluid Type (%):	WATER	WATER
Circuit No. of Passes:	2	2
Fouling Factor (ft <sup>2</sup> °F hr / Btu):	0.00010	0.00025
Tube No. / Description:	271 - 0.025" Enhanced Copper	266 - 0.025" CSL Enhanced Copper (1")
Design Working Pressure (psig):	150	150
Entering Water Nozzle @ Location:	2	12
Leaving Water Nozzle @ Location:	3	13
Water Box Weight, ea (lbs)(2):	777	522*
Cover Plate Weight , ea (lbs):	1080	500
Return Head Weight (lbs):	276	176
Water Weight (lbs):	2819	2318
Water Volume(gal):	338	278

Performance Data		Electrical Data		Other	
Job KW:	416	Job FLA:	586	Operating Wt. (lbs):	36040
Motor KW:	406	Motor FLA:	574	Per Isolator (lbs):	9010
KW/Ton:	0.555	LRA:	3810	Refrigerant Wt. (lbs):	2735
NPLV (1):	0.361	Inrush Amps:	586	Oil Charge (gal):	20
Gear Code:	RE	Min Circuit Ampacity (Amps):	733	Motor Wt. (lbs):	2480
OptiSound Cntrl:	Yes	Max Fuse/Breaker:	1200	Compressor Wt. (lbs):	3500
Shaft HP:	514			Starter Wt. (lbs):	1408
Isolation Valves:	YES			Shipping Wt. (lbs):	28168
Oil Cooler Type:	Standard				
Condenser Inlet:	Standard				
		Type Starter: Variable Speed Drive			

Notes:

(1) Chiller NPLV value calculated to ARI Standard 550/590 equation.

(2) Not including cover plate on marine water boxes.

\* with applicable water flanges



# YK MAXE CHILLER Construction Features & Details

Project Name: VA Spinal Center	Contract Number:	
Location:	Date:	Rev Date:

<b>Unit Tag</b> <b>CH-1</b>	<b>Capacity (tons)</b> <b>750</b>	<b>KW/Ton</b> <b>0.555</b>	<b>NPLV</b> <b>0.361</b>	<b>Refrigerant</b> <b>R-134A</b>	
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Line #	Equipment Details	Qty.	
<b>01A-</b>	<b>Base Unit/Access. - YKKQK4H9-CUGS</b>		
	Base Chiller Model No.: YKKQK4H9-CUGS		
	Shell/Compressor Package: KQK4 Shells w/ H9 Compressor	2	
	OptiSound Control	2	
	Motor Package & Options		
	Low Voltage Motor Package (60 Hz): CU	2	
	Evaporator Design & Options		
	Evaporator Marine Water Box (2 Pass, 150 PSIG DWP)	2	
	Evaporator Tube No.: 271 (0.025" Enhanced Copper)	2	
	Grooved Nozzle Connection (ANSI/AWWA C-606)(12")	2	
	Factory Thermal Insulation for Evaporator - 1 1/2" (38 mm)	2	
	Condenser Design & Options		
	Condenser Marine Water Box (2 Pass, 150 PSIG DWP)	2	
	Condenser Tube No.: 266 (CSL 0.025" Enhanced Copper (1"))	2	
	Condenser Water Connection Flange (10") 150# class RF (raised-face) ANSI B16.5	2	
	Other Options		
	NEMA 1 Control Panel and Wiring, 40-110 Ambient ASHRAE Standard 90.1 Compliance Label	2	



# YK MAXE CHILLER Construction Features & Details

Project Name: VA Spinal Center	Contract Number:	
Location:	Date:	Rev Date:

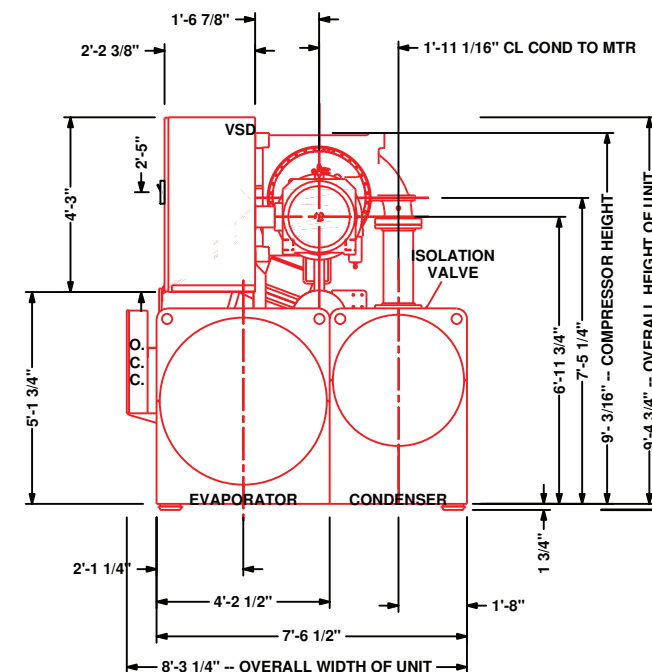
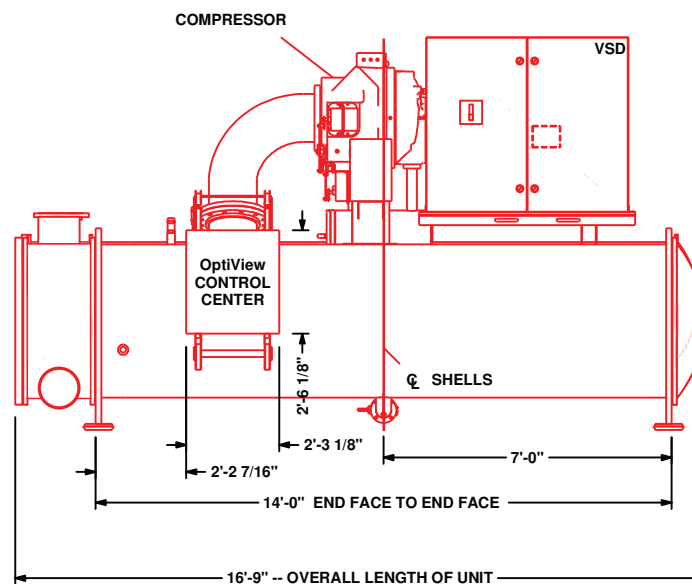
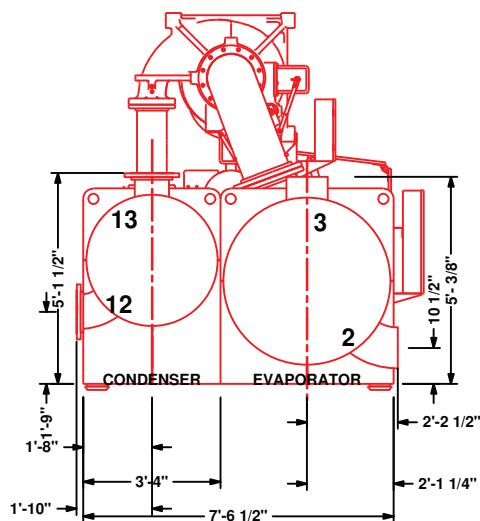
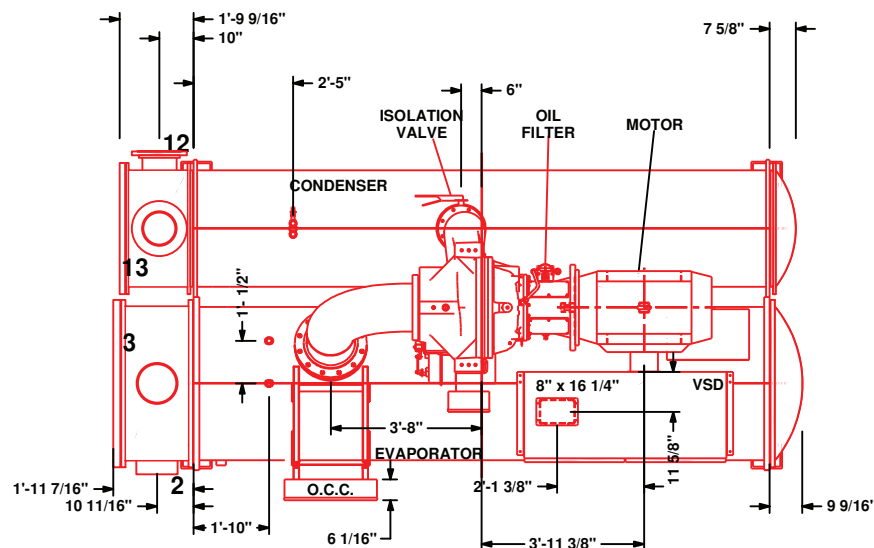
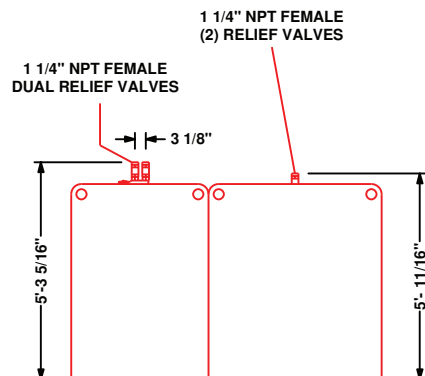
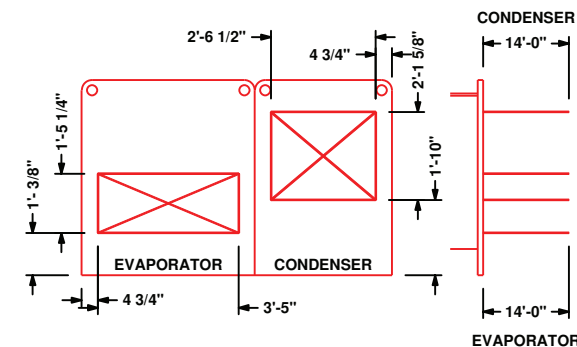
Line #	Equipment Details	Qty.	
<b>01A-</b>	<b>Base Unit/Access. - YKKQK4H9-CUGS - cont'd</b>		
	Isolation Valves	2	
	Form 2 Shipment (Refrigerant shipped separately)	2	
	Long Term Storage Preparation	2	
	Complete Chiller Wrapping	2	
	Buy American Act Compliance Required	2	
<b>02A-</b>	<b>Starter - Variable Speed Drive (460/3/60)</b>		
	Variable Speed Drive For CU Motor	2	
<b>03</b>	<b>Connectivity - BACnet</b>		
	2 Field Installed BACNet (MS/TP) E-Link for OptiView Chiller Panel	2	3464
<b>04</b>	<b>Start up/PCAT - Region: NorthEast in 2009</b>		
	Startup [9 day(s)] to occur during 2009 in Region: NorthEast	1	
<b>05</b>	<b>Entire Unit Warranty - 42 Month Parts and Labor</b>		
	42 Month (2-3 Year) Parts and Labor (8362) Extended Warranty Does Not Include Starter	2	
<b>06</b>	<b>VSD Warranty - 42 Month Parts and Labor</b>		
	42 Month (2-3 Year) Parts and Labor (8373)	2	

# NOZZLE LEGEND

EVAPORATOR INLET "2" 2 PASS 12 DIA. (150 Psig DWP)  
 EVAPORATOR OUTLET "3" 2 PASS 12 DIA. (150 Psig DWP)  
 CONDENSER INLET "12" 2 PASS 10 DIA. (150 Psig DWP)  
 CONDENSER OUTLET "13" 2 PASS 10 DIA. (150 Psig DWP)

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 Victaulic Grooved Nozzles (per ANSI / AWWA C-606)

## TUBE PULL AREA DETAIL



SHIPPING WT.: 28168 LBS, OPERATING WT. 36040 LBS, LOAD PER ISOLATOR 9010 LBS

## PRODUCT DRAWING

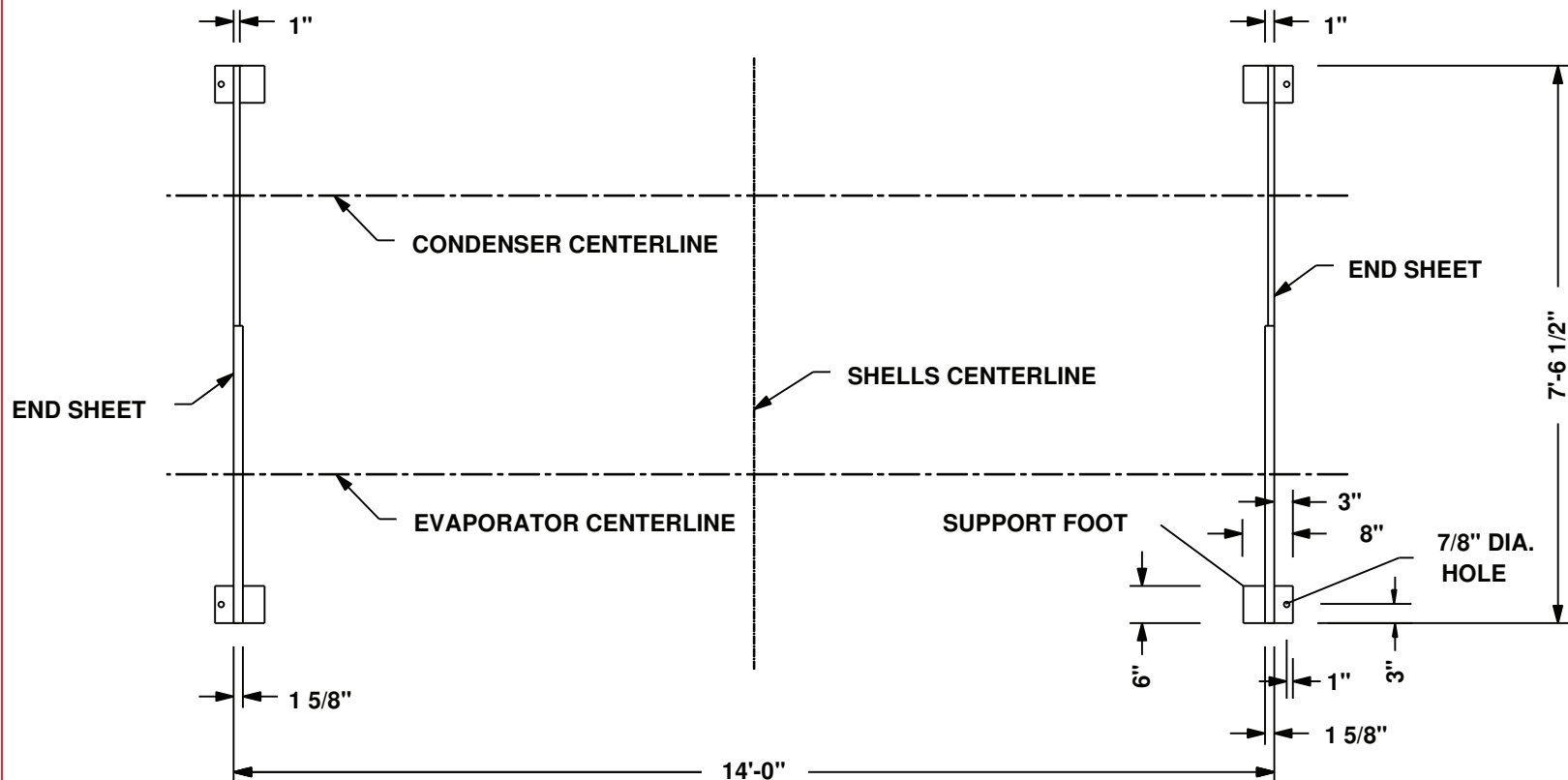
MaxE Centrifugal Liquid Chiller  
 MODEL YK KQ K4 H9 - CU G  
 NOT FOR CONSTRUCTION

Project Name : VA Spinal Center  
 Location :  
 Engineer :  
 Contractor :  
 For : N/A

Sold To :  
 Cust Purch Order# :  
 York Contract# :  
 UNIT  
 TAG: CH-1

Date : Nov 10, 2009  
 Rev. Date : 11:02 AM  
 Form: 160.75-EG1  
 Dwg. Lev. : 1006  
 Dwg. Scale : NTS

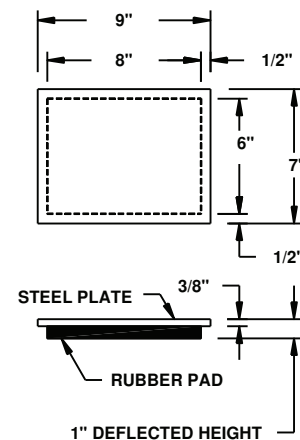
**YORK**  
 A JOHNSON CONTROLS COMPANY



DIMENSIONS ARE TYPICAL ALL FOUR CORNERS

## FLOOR LAYOUT (NOT TO SCALE)

### ISOLATOR DETAIL (N.T.S.)



ISOLATOR TO BE CENTERED  
UNDER SUPPORT FOOT

### PRODUCT DRAWING

FLOOR LAYOUT W/NEOPRENE ISOLATORS  
MODEL YK KQ K4 H9 - CU G  
NOT FOR CONSTRUCTION

Project Name : VA Spinal Center  
Location :  
Engineer :  
Contractor :  
For : N/A

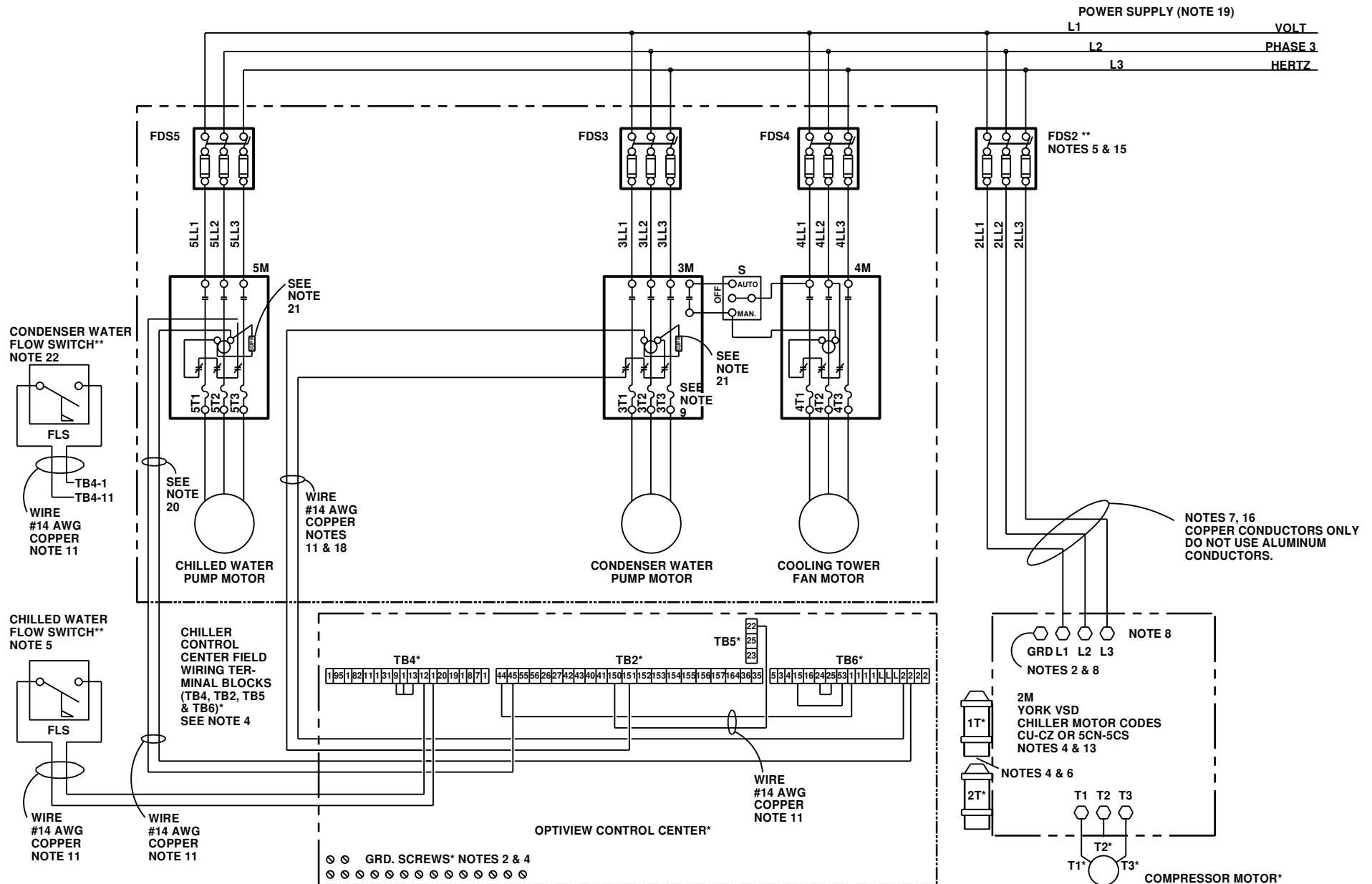
Sold To :  
Cust Purch Order# :  
York Contract# :

UNIT  
TAG: **CH-1**

Date : Nov 10, 2009  
Rev. Date : 11:03 AM  
Form: 160.75-EG1  
Dwg. Lev. : 1006  
Dwg. Scale : NTS

**YORK**  
A JOHNSON CONTROLS COMPANY

# WIRING DIAGRAM - FIELD CONNECTIONS (MOTOR CODES CU-CZ,CA,CB,DA,DB OR 5CN-5CX,5DA) (VARIABLE SPEED DRIVE)



## PRODUCT DRAWING

OPTIVIEW CONTROL Center  
WITH VARIABLE SPEED DRIVE  
NOT FOR CONSTRUCTION

Project Name : VA Spinal Center  
Location :  
Engineer :  
Contractor :  
For : N/A

Sold To :  
Cust Purch Order# :  
York Contract# :  
UNIT  
TAG: CH-1

Date : Nov 10, 2009  
Rev. Date : 11:04 AM  
Form No.: 160.75-PW3  
Dwg. Lev. : 1006  
Dwg. Scale : NTS

**YORK**  
A JOHNSON CONTROLS COMPANY



SUPERCEDES: 160.54-PW6 (207)

FORM 160.54-PW6 (407)

# WIRING DIAGRAM – FIELD CONNECTIONS

## MILLENNIUM® MODEL YK CHILLERS

### (STYLE F & G) WITH VARIABLE SPEED DRIVE

YORK DIVISION OF JOHNSON CONTROLS  
P.O. BOX 1592, YORK, PA 17405  
©by Johnson Controls 2007

CONTRACTOR:

ORDER NO.:

YORK CONTRACT NO.:

YORK ORDER NO.:

PURCHASER:

JOB NAME: **VA Spinal Center**

LOCATION:

ENGINEER:

<input type="checkbox"/>	REFERENCE	DATE: <input type="checkbox"/>	APPROVAL	DATE: <input type="checkbox"/>	CONSTRUCTION	DATE: _____
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### JOB DATA:

CHILLER MODEL NO.:	<b>YKKQK4H9-CUGS</b>	NUMBER OF UNITS:	<b>2</b>
MOTOR/VARIABLE SPEED DRIVE POWER:	<b>460 VOLTS, 3-PHASE, 60 Hz</b>		

### NOTES:

- All field wiring shall be in accordance with the current edition of the National Electrical Code (N.E.C.) as well as all other applicable codes and specifications.
- Variable Speed Drive (VSD) shall be grounded in accordance with the 1999 N.E.C. (Paragraph 250-118) for equipment grounding. Flexible conduit is required for final connection to the VSD. When a separate grounding conductor is required, it must be a copper conductor only and sized per the N.E.C. (Table 250-122). Per the 1999 N.E.C. (Paragraph 250-120(f)(1)), where multiple (parallel) conduits are used each must contain a grounding conductor. See Note 8 for grounding lug wire range.
- Wiring, electrical conduit, junction boxes, fused disconnect switches (FDS), or circuit breakers, starters (M), push-button stations (PB), manual-off-automatic switch (S), flow switch (FLS), and control relays furnished by others unless otherwise specified.
- Items marked \* furnished by York International Corporation.
- Items marked \*\* available from York International Corporation at additional cost.
- Control power supply 115V - 50/60 Hz, 2.0/3.0 KVA capacity for control center only, is supplied by a control power transformer(s) (1T)/(2T) mounted inside the VSD (460V, 60 Hz chiller motor code CF-CT or 575V, 60 Hz motor code CF-CV or 50Hz 5CC-5CM) or outside the VSD (60 Hz chiller motor code CU-CB or 50 Hz 5CN-DA) as shown. It is factory wired.
- VSD power conduit connection (cut holes to suit) locations per Product Drawing Form 160.55-PA1. Flexible conduit must be used for final connections to VSD. Multiple conduits shall contain an equal number of wires from each phase in each conduit to prevent overheating per the 1999 N.E.C. (Paragraph 300-20(a)). Use copper conductors only; DO NOT USE aluminum conductors. See Note 8 for factory furnished VSD terminal lug wire ranges and conduit connection provisions.

- A removable cover plate with pilot knockouts is supplied for connection of power supply conduits.

Input Voltage/Frequency	Chiller Motor Code	No. of conduits – Max T
575V/600V/60Hz	CF-CR	(2) 2-1/2 in.
440V/460V/480V/60Hz	CF-CN	
380V/400V/50Hz	5CC-5CI	
575V/600V/60Hz	CS-CV	(2) 3 in. or (3) 2-1/2 in.
440V/460V/480V/60Hz	CP-CT	
380V/400V/50Hz	5CJ-5CM	
440V/460V/480V/60Hz	CU-CZ, CA,CB,DA,DB	(4) 3 in.
380V/400V/50Hz	5CN-5CX, 5DA	

The following terminal lugs are factory furnished for field wiring supply connections. All lugs are related AL9CU.

Input Voltage/ Frequency	Chiller Motor Code & VSD Crt. Brk. Rating	Line Lugs		Grounding Lug Wire Range Quantity
		BBL Per Terminal	Wire Range	
575V/600V/60Hz	CF-CR, 400A	2	2/0-350 kcmil	#6 AWC 250 Kcmil, bbl.
440V/460V/480V/60Hz	CH-CN, 400A			
380V/400V/50Hz	5CC-5CI, 400A			
575V/600V/60Hz	CS-CV, 600A	2	3/0-500 kcmil	#6 AWC 250 Kcmil, bbl.
440V/460V/480V/60Hz	CP-CT, 600A			
380V/400V/50Hz	5CJ-5CM, 600A			
440V/460V/480V/60Hz	CU-CZ, CA,CB,DA,DB, 1200A	4	3/0-500 kcmil.	#4 AWC 500 Kcmil, bbl.
380V/400V/50Hz	5CN-5CX, 5DA, 1200A			



9. Condenser water pump motor starter (3M) holding coil to be furnished for 115V - 50/60 Hz. The power requirements for the water pump starter (3M) must be a max. of 1 Amp holding and 10 Amps inrush. If power requirements exceed this value, furnish coil for line voltage, and control relay with 115V coil.
10. Units shipped knocked down require field connection of harnesses to control center, power wiring between compressor motor and VSD, and oil pump starter to VSD. These harnesses and power wiring are furnished by York International Corporation for field assembly and consist of proper lengths of flexible conduit with necessary connectors, and contain the wires (shown in Note 13) properly terminated and marked
11. Wire #14 AWG copper for one way distance of less than 175 feet. Wire #12 AWG copper for one way distance of more than 175 feet, but less than 300 feet.
12. Wiring diagram for YORK control center Form 160.54-PW3. Field wiring modifications per Form 160.54-PW7. Wiring diagrams for YORK Variable Speed Drive Forms 160.00-PW1, 160.00-PW2 or 160.00-PW3.
13. The following interconnecting wires are factory supplied when a YORK Variable Speed Drive is used.
  - (a) VSD to control center - L, 2, 16, 24, 53; 3-conductor shielded cable; 4-conductor shielded cable (VSD harmonic filter option only).
  - (b) VSD to oil pump motor starter - 67, 68, 69.
14. 60 Hz oil pump motor for compressor is 2 HP. Full load amperes for oil pump drive panel (furnished by York International Corporation with VSD factory wired) and 3.0 KVA or (2) 2.0 KVA control power transformer(s) (furnished by York International Corporation and factory wired) are:

3 Phase Voltage	Hertz	Oil Pump Drive Panel (Amps)	Control Power Transformer(s) (Amps)
575/600	60	2.9	5.2 (Motor code CF-CV)
440/460/480	60	3.6	6.5(Motor Code CH-CT)
380/400	50	4.3	7.5(Motor Code 5CC-5CM)
440/460/480	60	3.6	8.7(Motor Code CU-DB)
380/400	50	4.3	10.0(Motor Code 5CN-5DA)

15. The branch circuit overcurrent protection device for the YORK VSD must be a time delay type with a rating which is the standard fuse/circuit breaker size required to protect the field supply wiring conductors per the N.E.C.
16. The YORK Variable Speed Drive power supply wiring ampacity shall be calculated as follows.

Model YK minimum circuit ampacity:

Ampacity = 1.25 (Job FLA)

Where 125% factor per 1999 N.E.C. (Para. 440-33).

17. The VSD is equipped with a U.L. Listed ground fault sensing circuit breaker sized per the following table. Fast acting semiconductor fuses are employed after the circuit breaker to provide additional protection to the VSD. The ground fault sensor is factory set to trip instantaneously when a ground fault is detected.
18. Control circuit wiring for 3M condenser water pump motor starter is shown for cooling only application. For units with Flash miniature card software version C.MLM.01.00 through C.MLM.01.03, the condenser water pump should be wired to terminal 164 of TB2 instead of terminal 151, AND the wire from terminal 22 of TB5 to terminal 150 of TB 2 shall not be installed. For software version C.MLM.01.04 and higher, the condenser pump connection should

be as shown in the figure.

Input Voltage/ Frequency	Chiller Motor Code	VSD Circuit Bkr. Rating (Amps)@ 600 VAC, 60Hz or 480 VAC, 60 Hz or 400 VAC, 50 Hz		Semiconductor Fuse Rating (Amps) @ 700 VAC
		Trip	Withstand	
575V/600V/60Hz	CF-CR	400	35,000*†	N/A
440V/460V/480V/60Hz	CF-CN	400	65,000*†	
380V/400V/50Hz	5CC-5CI			
575V/600V/60Hz	CS-CV	600	50,000*†	N/A
440V/460V/480V/60Hz	CP-CT	600	100,000*†	
380V/400V/50Hz	5CJ-5CM			
440V/460V/480V/60Hz	CU-CZ	1200	100,000*†	1100
380V/400V/50Hz	5CN-5CS			
Input Voltage/ Frequency	Chiller Motor code	VSD Circuit Bkr. Rating (Amps) @ 600 VAC, 60 Hz or 480 VAC, 60 Hz or 400 VAC, 50Hz		Semi- Conductor Fuse Rating (Amps) @ 660 VAC
		Trip	Withstand	
440V/460V/480V/60Hz	CA,CB, DA,DB	1200	100,000*†	1600
380V/400V/50Hz	5CT – 5CX, 5DA			

\* Per U.L. Listing of VSD

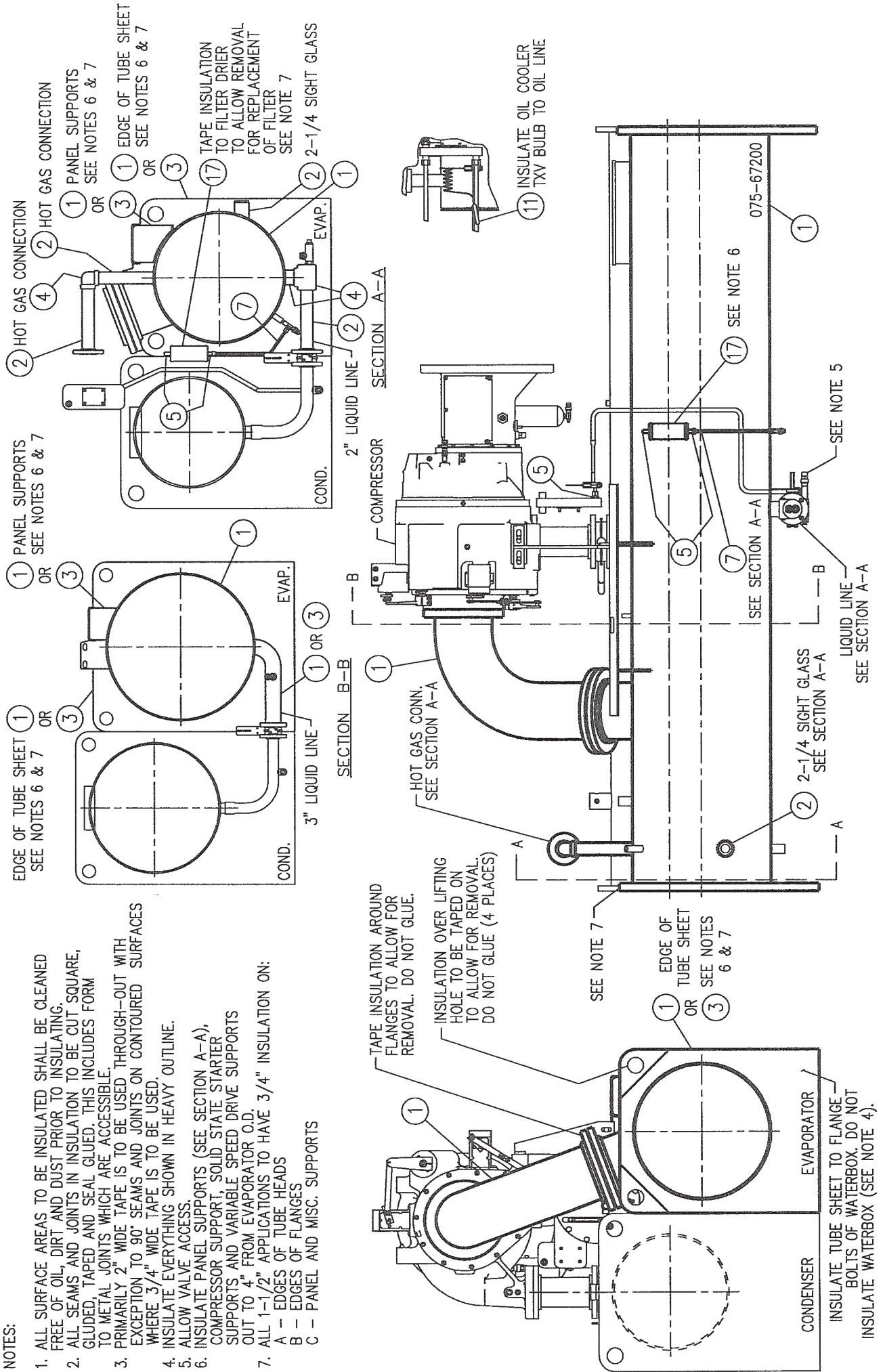
† RMS Symmetrical Amperes

19. The main power transformer should be adequately sized such that the transformer voltage drop does not exceed 10% during unit start-up. The supply voltage, at VSD input terminals, during start-up must be maintained above 489 volts for 575V/600V, 391 volts for 440V/460V/480V 60 Hz units and 323 volts for 380V/400V 50 Hz units. The allowable supply voltage range during normal operation is 520 to 635VAC, 3-Phase 575V/600V, 60 Hz or 414 to 508VAC, 3-Phase, 440V/460V/480V 60 Hz or 342 to 423 VAC, 3-Phase, 380V/400V 50 Hz.
  20. Automatic control of the chilled water pump by the control center is shown. Chilled water pump motor starter (5M) holding coil to be furnished for 115V - 50/60 Hz. The power requirements for the water pump starter (5M) must be a maximum of 1 Amp holding and 8 Amps inrush. If power requirements exceed this value, furnish coil for line voltage, and control relay with 115V coil (see Note 21).
- The pumps operate during oil pump prerun, during compressor operation & during cycling shutdown.
- For manual chilled water pump control, connect a manual start/stop switch as shown in the Field Connections diagram on page 3 or 5 for 115VAC coils only.
21. Each 115VAC field-connected inductive load, i.e. relay coil, motor starter coil, etc. shall have a transient suppressor wired (by others) in parallel with its coil, physically located at the coil. Spare transient suppressors are factory supplied in a bag attached to the keypad cable clamp in the OptiView Control Center.
  22. The Condenser Flow Switch is optional. If not present, a jumper must be installed between TB4-11 and TB4-1.

# THERMAL INSULATION DRAWING

## NOTES:

1. ALL SURFACE AREAS TO BE INSULATED SHALL BE CLEANED FREE OF OIL, DIRT AND DUST PRIOR TO INSULATING.
2. ALL SEAMS AND JOINTS IN INSULATION TO BE CUT SQUARE, GLUED, TAPED AND SEAL GLUED. THIS INCLUDES FORM TO METAL JOINTS WHICH ARE ACCESSIBLE.
3. PRIMARILY 2" WIDE TAPE IS TO BE USED THROUGH-OUT WITH EXCEPTION TO 90° SEAMS AND JOINTS ON CONTOURED SURFACES WHERE 3/4" WIDE TAPE IS TO BE USED.
4. INSULATE EVERYTHING SHOWN IN HEAVY OUTLINE.
5. ALLOW VALVE ACCESS.
6. INSULATE PANEL SUPPORTS (SEE SECTION A-A), COMPRESSOR SUPPORT, SOLID STATE STARTER SUPPORTS AND VARIABLE SPEED DRIVE SUPPORTS OUT TO 4" FROM EVAPORATOR O.D.
7. ALL 1-1/2" APPLICATIONS TO HAVE 3/4" INSULATION ON:
  - A - EDGES OF TUBE HEADS
  - B - EDGES OF FLANGES
  - C - PANEL AND MISC. SUPPORTS



# YK MOD G - THERMAL INSULATION RECOMMENDATIONS ( A - M SHELLS, WITH/ Q, P or H COMPRESSORS )

## 1 - 1/2" INSULATION - WITHOUT/HOT GAS BY-PASS --- English

ITEM NO.	DESCRIPTION	COOLER CODE										
		A	C	D	E	F	G	H	J	L	H9/K	H9/M
1	INSULATION - 1-1/2" thick - SHELL ONLY - (SQ. FT.)	199	199	243	221	265	265	310	288	354	354	354
	42" to 49" width x 65" long x 1-1/2" thick (EA.)	9	9	11	10	12	12	14	13	16	16	16
	COOLER WITH: (SQ. FT.)											
	COMPACT WATER BOXES (150#)	218	222	266	251	295	301	346	332	398	398	413
	COMPACT WATER BOXES (300#)	220	226	270	255	299	307	352	337	403	403	411
	MARINE WATER BOXES (150#)	234	246	290	282	326	336	381	373	439	439	454
	MARINE WATER BOXES (300#)	235	247	291	284	328	341	386	379	445	445	460
	WATER BOXES ONLY: (SQ. FT.)											
	COMPACT WATER BOXES (150#)	19	23	23	30	30	36	36	44	44	44	59
	COMPACT WATER BOXES (300#)	21	27	27	34	34	42	42	49	49	49	57
	MARINE WATER BOXES (150#)	35	47	47	61	61	71	71	85	85	85	100
	MARINE WATER BOXES (300#)	36	48	48	63	63	76	76	91	91	91	106
2	INSULATION RD - 2.500 I.D. x 3/4" wall thk. x 6 ft. long (EA.)	3	3	3	3	3	3	3	3	3	3	3
3	INSULATION - 42" to 49" width x 65" long x 3/4" thick (SQ.FT.)	44	44	44	44	44	33	33	33	44	44	44
	(EA.)	2	2	2	2	2	1.5	1.5	1.5	2	2	2
4	INSULATION - 2-7/8" I.D. x 3/4" wall thk. x 6 ft. long (FT.)	1	1	1	1	1	1	1	1	1	1	1
5	INSULATION - 1-3/8" I.D. x 3/4" wall thk. x 6 ft. long (FT.)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	INSULATION - 3/8" I.D. x 3/4" wall x 6 ft. long (FT.)	3	3	3	3	3	3	3	3	3	3	3
8	ELECTRICAL TAPE - 2" wide x .007 thk. x 108 ft. long (FT.)	100	100	100	114	114	100	114	100	114	114	114
9	ELECTRICAL TAPE - 3/4" wide x .007 thk. x 66 ft. long (FT.)	100	100	100	114	114	100	114	100	114	114	114
10	ADHESIVE SCOTCH GRIP - gallon (GL.)	0.432	0.432	0.432	0.432	0.432	0.5	0.5	0.5	0.5	0.5	0.5
11	INSULATION - 3/4" I.D. x 3/4" wall thk. x 6 ft. long (FT.)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
17	INSULATION - 2-1/2" I.D. x 3/4" wall thk. x 6 ft. long (EA.)	1	1	1	1	1	1	1	1	1	1	1

**YK MOD G - THERMAL INSULATION RECOMMENDATIONS ( A - M SHELLS, WITH/ Q, P or H COMPRESSORS )**  
**38 mm INSULATION - WITHOUT/HOT GAS BY-PASS --- Metric**

ITEM		DESCRIPTION		COOLER CODE									
NO.	A			C	D	E	F	G	H	J	L	H9/K	H9/M
1													
	INSULATION - 38mm thick - SHELL ONLY - (SQ. M.)	19	19	23	21	25	25	29	27	33	33	33	
	1067 to 1245 width x 65" long x 38mm thick (EA.)	9	9	11	10	12	12	14	13	16	16	16	
	COOLER WITH: (SQ. M.)												
	COMPACT WATER BOXES (150#)	21	21	25	24	28	28	33	31	37	37	39	
	COMPACT WATER BOXES (300#)	21	21	26	24	28	29	33	32	38	38	39	
	MARINE WATER BOXES (150#)	22	23	27	27	31	32	36	35	41	41	43	
	MARINE WATER BOXES (300#)	22	23	28	27	31	32	36	36	42	42	43	
	WATER BOXES ONLY: (SQ. M.)												
	COMPACT WATER BOXES (150#)	2	3	3	3	3	4	4	5	5	5	6	
	COMPACT WATER BOXES (300#)	2	3	3	4	4	4	4	5	5	5	6	
	MARINE WATER BOXES (150#)	4	5	5	6	6	7	7	8	8	8	10	
	MARINE WATER BOXES (300#)	4	5	5	6	6	8	8	9	9	9	10	
2	INSULATION RD - 64mm I.D. x 19mm wall thk. x 1.83M. long (EA.)	3	3	3	3	3	3	3	3	3	3	3	
3	INSULATION - 1067 to 1245mm width x 1651mm long x 19mm thick (SQ.M.)	5.0	5.0	5.0	5.0	5.0	4.0	4.0	4.0	5.0	5.0	5.0	
4	INSULATION - 73 I.D. x19mm wall thk. x 1.83M long (M.) (EA.)	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	2.0	2.0	2.0	
		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
5	INSULATION -35mm I.D. x 19mm wall thk. x 1.83M long (M.)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
7	INSULATION - 10mm I.D. x 19mm wall x 1.83M long (M.)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	
8	ELECTRICAL TAPE - 51mm wide x .1778mm thk. x 32.91M long (M.)	30.5	30.5	30.5	34.7	34.7	30.5	34.7	30.5	34.7	34.7	34.7	
9	ELECTRICAL TAPE - 19mm wide x .1778, thk. x 20.11M. long (M.)	30.5	30.5	30.5	34.7	34.7	30.5	34.7	30.5	34.7	34.7	34.7	
10	ADHESIVE SCOTCH GRIP - litre (L.)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
11	INSULATION - 19mm I.D. x 19mm wall thk. x 1.83M. long (M.)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
17	INSULATION - 64mm I.D. x 19mm wall thk. x 1.83M. long (EA.)	1	1	1	1	1	1	1	1	1	1	1	



# CHILLER Equipment Release / Configuration Process

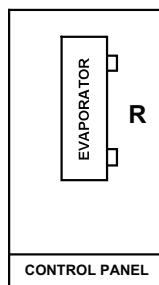
Attached you will find preliminary drawings and performance representing the unit(s) we are submitting on this project. Please review these forms, make any required modifications, sign each page indicating your approval and then fax them back to my attention. Please note that equipment cannot be released for fabrication until these forms are completed and returned with your signature of approval. Please feel free to contact me if you have any questions regarding the attached information.

Unit Section	Items for Review	Potential Configurations
<b>Electrical</b>	Main unit voltage	208, 230, 460, 480, or 4160
	Control Voltage	115, 208, 230, 460, 480, Single or Three Phase
	Type of Electrical Connection	Single or Multiple Point
	Connection	Lugs per Phase
	Starter	Unit Mounted or Remote Mounted
	Electrical Protection	Breaker or Disconnect Size
	Electrical Protection Type	Terminal Block, Disconnect or Circuit Breaker
<b>Evaporator &amp; Condenser</b>	Water Cooled Chiller Piping Connections	One or Two
	Connection Type	Victaulic or Flanged
	Passes	One, Two or Three
	Water Box Type	Compact or Marine
	Waterside Pressure	150 psig or 300 psig
	Proof of Flow	Flow Sensors or Flow Switches
	Evaporator Insulation	None, 3/4" or 1-1/2"
<b>General</b>	Unit Height	Please review contract drawings to approve attached dimensions
	Unit Width	Please review contract drawings to approve attached dimensions
	Unit Length	Please review contract drawings to approve attached dimensions
	Unit Weight	Please review contract drawings and approve
	Form 1 Shipment (Models: YK, YR, YD or YS)	Completely Assembled w/ Refrigerant in Unit
	Form 2 Shipment (Models: YK, YR, YD or YS)	Completely Assembled w/ Refrigerant Shipped Loose
	Form 3 Shipment (Models: YK, YR, YD or YS)	Two Piece Shipment: Driveline and Shell Assembly
	Form 7 Shipment (Models: YK, YR, YD or YS)	Three Piece Shipment: Driveline, Evaporator and Condenser
	Form 8 Shipment (Models: YR)	Completely Assembled w/ Oil Separator Shipped Loose

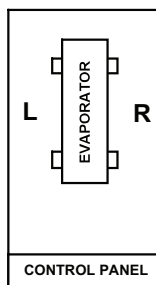
## AIR COOLED

## WATER COOLED

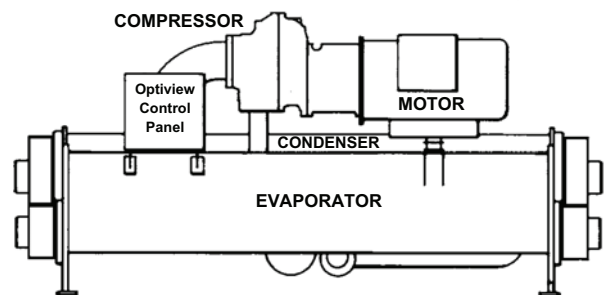
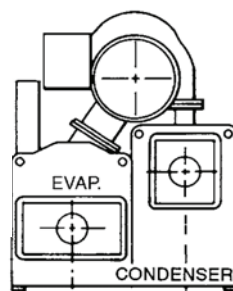
YCAL, YLAA,  
YCAV



YCIV



**NOTE:** Evaporator hand is determined by facing the control section



## Important Notes:

- 1) Actual fabrication release cannot commence until this form is **confirmed by the customer and returned to JCI**
- 2) The release process cannot commence until **written** release notification is issued by customer including **want date** and **ship to address**
- 3) Equipment "**lead-time**" **does not start** until confirmed release documentation is received
- 4) Modifications to equipment configurations after fabrication release may impact cost and lead-time
- 5) Configurations noted below are as shown in the approved equipment submittals or as defined in superseding customer correspondence
- 6) Material handling of loose refrigerant between delivery truck and chiller room is customer's responsibility
- 7) Note that once this document is confirmed, the equipment configurations defined by this document take precedence over all other documents
- 8) "Want date" and/or "ship to address" changes made after this document is confirmed may impact cost and lead-time

## RECEIVING / RIGGING INSTRUCTIONS

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The installing contractor is responsible to provide Johnson Controls / YORK with a contact to coordinate the delivery of the equipment in this submittal. Please fill out the information requested in the Submittal Approval Form section in the back of this submittal.

It is the installing contractor's responsibility to verify the following prior to signing the bill of lading presented by the transportation company:

- Ensure everything on the bill of lading was delivered.
- Visually perform a thorough inspection of all equipment for any signs of shipping damage

***Any short-shipments or shipping damage must be noted on the bill of lading prior to signing.***

The transportation company will provide you with instructions for filing a claim. It is the installing contractor's responsibility to work directly with the transportation company to resolve any shipping claims.

	<b>LIMITED WARRANTY ENGINEERED SYSTEMS EQUIPMENT</b>	
<b>SERVICE POLICY</b>	Supersedes: 50.05-NM2 (1008)	Form 50.05-NM2 (309)

## POLICY STATEMENT

Johnson Controls, Inc. (JCI) warrants all new Engineered Systems Equipment and materials, or installation or start-up services performed by JCI in connection therewith, against defects in workmanship and material for a period of eighteen (18) months from date of shipment or twelve (12) months from date of start-up, whichever occurs first. This warranty does not extend to products used for rental chiller duty. Subject to the exclusions listed below, JCI, at its option, will repair or replace, FOB point of shipment, such JCI products or components as it finds defective.

Except for reciprocating replacement compressors, which JCI warrants for a period of twelve (12) months from date of shipment, JCI reconditioned or replacement materials, or installation or start-up services performed by JCI in connection therewith, warrants against defects in workmanship and material for a period of ninety (90) days from date of shipment. Subject to the exclusions listed below, JCI, at its option, will repair or replace, FOB point of shipment, such JCI products or components as it finds defective.

### Exclusions:

Unless specifically agreed to in the contract documents, this warranty does not include the following costs and expenses:

1. Labor to remove or reinstall any equipment, materials, or components.
2. Shipping, handling, or transportation charges.
3. Cost of refrigerant.
4. Cost of rental chillers or other temporary cooling equipment.

No warranty repairs or replacements will be made until payment for all equipment, materials, or components has been received by JCI.

### ALL WARRANTIES ARE VOID IF:

1. Equipment is used with refrigerants, oil, or antifreeze agents other than those authorized by JCI.

2. Equipment is used with any material or any equipment such as evaporators, tubing, other low side equipment, or refrigerant controls not approved by JCI.
3. Equipment has been damaged by freezing because it is not properly protected during cold weather, or damaged by fire or any other conditions not ordinarily encountered.
4. Equipment is not installed, operated, maintained and serviced in accordance with instructions issued by JCI.
5. Equipment is damaged due to dirt, air, moisture, or other foreign matter entering the refrigerant system.
6. Equipment is not properly stored, protected, or inspected by the customer during the period from date of shipment to date of initial start-up.
7. Equipment is damaged due to acts of god, abuse, neglect, sabotage, or acts of terrorists.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, EXPRESS OR IMPLIED IN LAW OR IN FACT, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE WARRANTIES CONTAINED HEREIN SET FORTH BUYER'S SOLE AND EXCLUSIVE REMEDY IN THE EVENT OF A DEFECT IN WORKMANSHIP OR MATERIALS. IN NO EVENT SHALL JCI'S LIABILITY FOR DIRECT OR COMPENSATORY DAMAGES EXCEED THE PAYMENTS RECEIVED BY JCI FROM BUYER FOR THE MATERIALS OR EQUIPMENT INVOLVED. NOR SHALL JCI BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. THESE LIMITATIONS ON LIABILITY AND DAMAGES SHALL APPLY UNDER ALL THEORIES OF LIABILITY OR CAUSES OF ACTION, INCLUDING, BUT NOT LIMITED TO, CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE) OR STRICT LIABILITY. THE ABOVE LIMITATIONS SHALL INURE TO THE BENEFIT OF JCI'S SUPPLIERS AND SUBCONTRACTORS.

